

2012 Distinguished Scientist Seminar

Semester in Environmental Science

The Ecosystems Center, MBL

Mark Kurz

*Senior Scientist, Dept. of Marine Chemistry and Geochemistry
Woods Hole Oceanographic Institution*

***Noble gases from the deep earth,
cosmogenic nuclides, landscape evolution
(and why biologists should care).***

September 14, 3:00 PM – Speck Auditorium
Rowe Building, MBL

Although biological activity has had a profound effect on the composition of the Earth's atmosphere, during the early evolution of planet, release of gases trapped in the mantle and the Earth's crust has been the major source of water and other volatiles to the atmosphere and ultimately the oceans. Through volcanism and the formation of new crust at tectonic plate boundaries, degassing of the crust continues today at a slow, but steady rate.



Because helium is chemically inert, the study of helium and its isotopes yields valuable insights into the geochemical history of the Earth and the atmosphere. Mark Kurz has been one of the pioneers in developing approaches to using helium isotopes to probe the history Earth's crust and landforms. He began, as a graduate student, studying the variability in the composition of noble gases trapped in volcanic rocks at submarine lava flows. These studies took him to the islands of Hawaii, Iceland and to the deep sea vents in the Galapagos, which were first discovered in 1977 on one of Mark's early research cruises. He has continued to work on deep sea vent systems and spreading centers including the mid-Atlantic Ridge and East Pacific Rise, as well as seamount volcanos - all serving as windows into the geologic history of the Earth.

In 1985, he discovered that ^3He was formed by the interaction of cosmic rays with major elements commonly found in minerals and rocks at the Earth's surface. This turned out to be a powerful tool for determining the age of landforms, and he was awarded the F.W. Clarke Medal by the Geochemical Society for this work. Since his discovery, Dr. Kurz and his colleagues have used cosmogenic helium isotopes to assess the expansion and shrinkage of glaciers in Patagonia and Antarctica in hopes of better understanding past climate regimes.

Dr. Kurz received his B.S., in Chemistry with Honors at the University of Wisconsin at Madison, and his Ph.D. in Geochemistry from the MIT/WHOI Joint Program in Oceanography in 1982. He was then awarded a NATO Postdoctoral Fellowship to study at the Universite Paris VII, Institut de Physique du Globe from 1982-1983, and returned to the Universite Paris as visiting professor in 1995, 2004, and 2012. He was appointed Assistant Scientist at WHOI in 1983 rising to senior scientist in 1996, and served as chair of the department of Marine Chemistry and Geochemistry from 1999-2003. He also received the Ruth and Paul Fye Award for Excellence in Oceanographic Research given by WHOI in 1982, and the Rosenstiel Award for Outstanding Achievement in Oceanography presented by the University of Miami in 1988. He was elected a fellow of the American Geophysical Union in 1997, fellow of the Geochemical Society in 2012, and received the Distinguished Alumni Award from the University of Wisconsin, Department of Geology and Geophysics in 2009.

Suggested Readings:

Kurz, M.D. and E.J. Brook (1994). Surface Exposure Dating with Cosmogenic Nuclides. Chapter 7 pp. 139-158 in: *Dating in Surface Context*, C. Beck (ed.), University of New Mexico Press.

2012 Distinguished Scientist Seminar Semester in Environmental Science The Ecosystems Center, MBL

Christine Goodale

*Associate Professor, Dept. Ecology and Evolutionary Biology
Cornell University*

Nitrogen deposition effects on forest carbon sequestration

September 21, 3:00 PM - Speck Auditorium,
Rowe Building, MBL



Since the mid-19th century when agriculture was largely abandoned in the northeast, forests in the region have been re-growing, accreting biomass, and they are an important sink for carbon dioxide. The northeastern U.S. also receives elevated atmospheric inputs of a variety of nitrogen compounds produced by burning fossil fuels and emissions from agriculture, including acid deposition. Christine Goodale's laboratory addresses a number of key research questions related to the effects of this N-deposition on forests including:

- How will changes in climate interact with N-deposition to affect forest growth, soil C stocks, and net carbon accumulation?
- What factors control the spatial and temporal patterns of watershed nitrogen retention?
- How do the legacies of past disturbances (e.g. logging and fire) affect current rates of carbon and nitrogen accumulation across the landscape?

She works at plot, watershed, landscape, regional, and continental scales -- linking field studies with ecosystem models. For example, her lab is currently studying the fate of ¹⁵N-nitrate added to a upper Susquehanna basin, nitrogen retention across Europe and eastern North America, and carbon storage in post-agricultural old-fields and forests. She's not afraid to get her hands dirty!

Dr. Goodale graduated from Dartmouth College, and received her masters and doctorate from the University of New Hampshire. She completed postdoctoral fellowships at the Carnegie Institution at Stanford University and the Woods Hole Research Center, and was appointed Assistant Professor at Cornell University in 2003 rising to tenured Associate Professor in 2010. She has won a number of awards including the department of energy Hollander Distinguished Postdoctoral fellowship, and a prestigious National Science Foundation Early Career Award in 2009.

She has contributed to environmental policy and management through service on a number of advisory committees and panels including the U.S. E.P.A. Critical Loads for Nitrogen in U.S. Ecosystems, Working Group, the U.S. E.P.A. Ecological Effects Subcommittee of the Advisory Council on Clean Air Compliance Analysis, the National Ecological Observation Network (NEON) Science, Technology, and Education Advisory Committee and the Union of Concerned Scientists panel, Confronting Climate Change in the U.S. Northeast.

Suggested Readings:

Thomas, RQ, CD Canham, KC Weathers, CL Goodale. 2010. Increased tree carbon storage in response to nitrogen deposition in the US. *Nature Geoscience* 3:13-17.

Pinder, RW, EA Davidson, CL Goodale, TL Greaver, JD Herrick, and L Liu. Climate change impacts of US reactive nitrogen. 2012. *Proceedings of the National Academy of Sciences of the United States of America*. 109(20):7671-7675.

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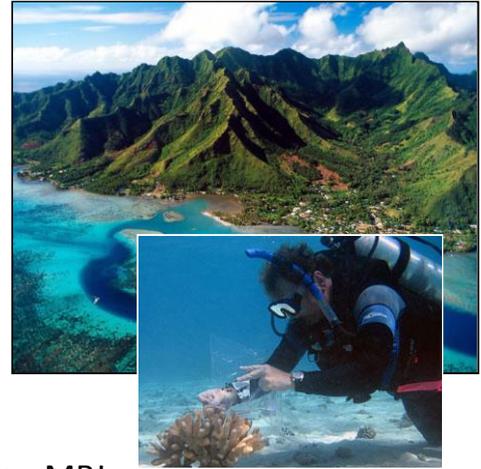
The Ecosystems Center, MBL

Russell Schmidt

Professor, Dept. Ecology and Evolutionary Biology
University of California, Santa Barbara

Abrupt state change and resilience in marine ecosystems: what coral reefs are telling us

October 5, 3:00 PM – G70 Lecture Hall, Loeb Laboratory, MBL



It is currently estimated that almost 20% of the world's coral reefs have been lost and another 35% are in serious danger of disappearing by 2050 due to the effects of coastal development, over-fishing, rising temperatures and ocean-acidification associated with global climate change.* Dr. Russ Schmidt is lead-principle investigator in the Moorea Long-Term Ecological Research Program (LTER), which is studying how global change is altering a complex system of coral reefs and lagoons surrounding the island of Moorea, French Polynesia in the South Pacific Ocean.

More generally, Dr. Schmidt is interested in the mechanisms that influence population abundance and dynamics, and affect species composition and diversity in ecological communities. His work has been centered in subtidal reef environments in temperate as well as tropical marine ecosystems. He makes extensive use of field experiments and observations to understand predator-prey and competition interactions and their effects on the population dynamics of benthic invertebrates and reef fishes.

He is also committed to applying science help mitigate environmental threats such of oil pollution and habitat destruction in coastal ecosystems. He has served as a scientific advisor or consultant to the US Department of Justice, the California Coastal Commission's Marine Review Committee, the Scientific Advisory Panel for the San Onofre Nuclear Generating Station, and the National Resources Defense Council. He has presented testimony to the U.S. House of Representatives Subcommittee on Coast Guard and Navigation, the Presidential Taskforce on Outer Continental Shelf Oil and Gas Development, and California State Assembly Select Committee on Oil Spill Prevention and Response Preparedness.

He received his B.A. in Environmental Biology from the University of Colorado, Boulder in 1972, M.S. in Marine Science from the University of the Pacific and Ph.D. from University of California, Los Angeles in 1979. He then moved to the University of California, Santa Barbara, taking a post-doctoral position with the renowned ecologist, Dr. J.H. Connell and transitioned to a professional research faculty position. In 1989 he received the George Mercer Award presented by the Ecological Society of America for his work on *Indirect interactions between prey; apparent competition, predator aggregation, and habitat segregation*. The Mercer award recognizes an outstanding ecological research paper published by an author under the age of forty. He was Eminent Visiting Ecologist at the Kellogg Biological Station, Michigan State University in 1991, and was appointed Associate Professor in 1993, rising to full professor in 1995. In 2004, he received the UC Santa Barbara Academic Senate Distinguish Teaching Award. In addition to his research and teaching obligations, Dr. Schmidt is Director, Coastal Research Center of the Marine Science Institute at UCSB, and Program Director for the Minerals Management Service - University of California Coastal Marine Institute Program.

References and Suggested Readings:

* <http://www.gcrmn.org/status2008.aspx>

Adam TC, Schmitt RJ, Holbrook SJ, Brooks AJ, Edmunds PJ, et al. (2011). Herbivory, Connectivity, and Ecosystem Resilience: Response of a Coral Reef to a Large-Scale Perturbation. *PLoS ONE* **6**(8): e23717. doi:10.1371/journal.pone.0023717

Bestelmeyer, BT, AM Ellison, WR Fraser, KB Gorman, SJ Holbrook, CM Laney, MD Ohman, DPC Peters, FC Pillsbury, A Rassweiler, RJ Schmitt, and S Sharma. 2011. Analysis of abrupt transitions in ecological systems. *Ecosphere* **2**(12):129. doi:10.1890/ES11-00216.1

2012 Distinguished Scientist Seminar

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The Ecosystems Center, MBL

Sarah Hobbie

*Professor, University of Minnesota
Dept. of Ecology, Evolution and Behavior*

Biogeochemical fluxes through households and neighborhoods in the Twin Cities, Minnesota

October 26, 3:00 PM – Lecture Hall G70,
Loeb Building, MBL



The world's population is increasingly concentrated in cities. Only recently have scientists begun to assess how cities function from an ecosystems perspective. The **Twin Cities Household Ecosystems Project (TCHEP)*** is a multi-disciplinary collaboration among a number of scientists attempting to understand the biophysical, socio-demographic and psychological factors that influence household decision making about activities like transportation, diet, home energy use, and landscape management. An important goal of this project is to assess the impacts that these decisions have on the health and functioning of urban ecosystems. Ultimately, the findings of the TCHEP will help inform individual decision making and policies designed to mitigate pollution arising from human activities in cities, and will foster a more sustainable model for urban living. Sarah Hobbie is one of the scientists leading this effort. She is biogeochemist with special expertise in the effects of environmental change on plant communities and nutrient cycling.

Dr. Hobbie received her doctorate at the University of California, Berkeley in 1995. While a graduate student, she received the Murray Buell Award for excellence in ecology given by the Ecological Society of America for outstanding work presented at the Society's annual meeting. The award recognized her research on the effect of increased temperature in Alaskan tundra on net ecosystem CO₂ uptake. She completed a postdoctoral fellowship at Stanford University and was appointed Assistant Professor at University of Minnesota in 1998 rising to full professor in 2012.

Dr. Hobbie is active in the National Science Foundation's Long-Term Ecological Research (LTER) program, with ongoing research at the Cedar Creek Ecosystem Science Reserve. She has served on the LTER Executive Board, on the National Center for Ecological Analysis and Synthesis Science Advisory Board, on NSF review panels, and contributed to a report for the Minnesota State Legislature evaluating the potential for the State's terrestrial ecosystems to sequester carbon. In 2000-01, she was named a University of Minnesota McKnight Land-Grant Professor (an honor reserved for the university's most promising junior faculty), and she received an Aldo Leopold Fellowship in 2008. Currently she is a Resident Fellow with the University of Minnesota's Institute on the Environment and serves as Director of Graduate Studies for the Ecology, Evolution and Behavior Graduate Program.

Suggested Readings:

*<http://www.tchep.umn.edu/>

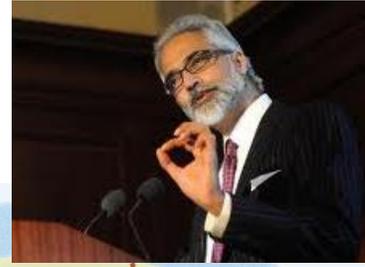
Kaye, J.P. et al. (2006). A distinct urban biogeochemistry? *Trends in Ecology and Evolution* **21**:192-199.

Grimm, N. et al. (2008). Global Change and the Ecology of Cities. *Science* **319**:756-760.

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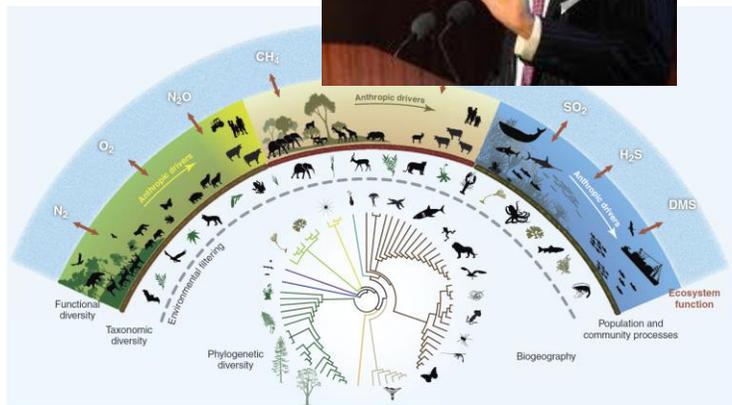
The Ecosystems Center, MBL



Shahid Naeem

Professor of Ecology, Columbia University
Dept. of Ecology, Evolution, and
Environmental Biology and
Director, Earth Institute Center for
Environmental Sustainability,

Biodiversity and Ecosystem Function



November 2, 3:00 PM – Lillie Auditorium, Lillie Building, MBL

Dr. Naeem and his students study how changes in biodiversity affect ecosystems and the services they provide. They have neither an organismal or system bias. They have worked on plants, animals (vertebrates or invertebrates), and microbes in marine, terrestrial, and freshwater habitats. Naeem and his colleagues believe that declines in biodiversity, either through local extinction or biological invasions, are the single most important and dramatic problem in contemporary ecology. Their laboratory motto is “ecology with no apology.”

Naeem and his students go beyond basic community and population ecology to understand how species losses affect ecosystem function. For example, removal of a top predator will certainly affect herbivore populations and those effects will cascade down to plants. Their studies go on to examine how plant inputs of C or N, through litter or root exudates, might affect soil fauna and microbial communities, and how such changes might alter soil metabolism and nutrient cycling. This integration of population and community ecology with biogeochemistry is cross-cutting and yields unique and important insights into the role of biodiversity in ecosystem function. Naeem’s current fieldwork is focused on American northeastern deciduous forests, Inner Mongolian grasslands in China and African agro-ecosystems. He is actively involved in using the scientific findings about biodiversity and ecosystem function to help formulate policies for conservation and restoration.

Dr. Naeem received both his undergraduate training and his Ph.D. from the University of California, Berkeley; and completed postdoctoral fellowships at the Imperial College of London, the University of Copenhagen and the University of Michigan. He served on the faculties of the University of Washington and the University of Minnesota before coming to Columbia in 2003. He is author, co-author and editor of over 100 scientific publications and co-chaired the UN Millennium Assessment’s Biodiversity Synthesis Report published in 2005. He was lead editor of the seminal book, *Biodiversity, Ecosystem Functioning, and Human Well-Being*, released in 2009, which summarizes over 900 studies that have explored how biodiversity loss threatens nature and our society.

His work has been widely recognized by the scientific community. He is an ISI widely cited author, and in 1995, won the Ecological Society of America’s Mercer Award for best ecological paper by younger ecologist. He was selected as a Fellow of the American Association for the Advancement of Science and an Aldo Leopold Leadership Fellow in 2001. He received Columbia’s Lenfest Award for excellence in teaching and research in 2008.

Suggested Readings:

Cardinale, B.J. et al. (2012). Biodiversity loss and its impact on humanity. *Nature* **486**:59-67

Naeem, S. et al. (2012). The function of biological diversity in the age of extinction. *Science* **336**:1401-1406.